

# IES Newsletter

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## Director's Note

From time to time an ecosystem is invaded by an animal or plant species that is new to that ecosystem. There often are no natural controls to repel these "exotic invaders," no way to keep them from outcompeting native species or disturbing their new ecosystem in other ways. Sometimes, however, there is an opportunity to anticipate the invasion, and to learn as much as possible about the target ecosystem before disturbance has occurred. These findings provide baseline data about the natural condition . . . data against which later changes can be compared.

In 1984, when deer ticks were first observed in Dutchess County, IES ecologists began monitoring the Arboretum's mammal population to gather invasion data that later were applied to a study of the ecology of this new pest. Now, aquatic ecologist Dr. David Strayer, with a grant from the Hudson River Foundation, is doing a baseline study of the animal communities of the Hudson River in anticipation of the inevitable arrival of the zebra mussel. The cover story in this issue of the IES NEWSLETTER describes Dr. Strayer's involvement with this exotic invader.

The IES Newsletter is published by the Institute of Ecosystem Studies at the Mary Flagler Cary Arboretum. Located in Millbrook, New York, the Institute is a division of The New York Botanical Garden. All newsletter correspondence should be addressed to the Editor.

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## The Zebra Mussel Invasion: An Ecologist's View

Dr. David Strayer's father lives near the western end of Lake Erie. In early 1989, he mentioned to his son, an aquatic ecologist at IES, how bad the zebra mussel situation was becoming in the lake. Dr. Strayer, who has a considerable background in studies of mollusks\* (the group of animals in which zebra mussels are classified) immediately became interested and began investigating the ecology of these small shellfish. He soon realized that not only were they likely to spread eventually to larger lakes and rivers throughout most of North America, but also that realistically there was nothing that could be done to stop them.

The European freshwater zebra mussel, *Dreissena polymorpha*, is a filter-feeder: it gets its food from phytoplankton, bacteria and small particles of organic debris suspended in the water. Adults spawn once the water temperature reaches 10° C (50° F) and continue to spawn all summer; during the peak summer density there may be as many as 100 larvae in one liter (approximately one quart) of water. These tiny larvae rise to the surface, spend some time in the plankton, and may even swim over short distances. Then they sink and anchor themselves to a hard substrate — rope, netting, stones, sticks, boat hulls — by means of tough threads, called a "byssus" or beard, that they excrete. At this point metamorphosis occurs and the larvae assume the appearance of miniature adult zebra mussels. The animals live from four to six years, depending on the water temperature, and grow to 3.8 - 5.0 cm (1.5 - 2 in.) in shell length.

Historically, zebra mussels have expanded their territories by passively taking advantage of river traffic. Before the late 1700s, zebra mussels were restricted to the upper Caspian and lower Volga regions of the southwestern U.S.S.R. As commercial navigation developed from 1795 to 1830, the mussels were transported upstream until they were in all of Europe's major ports. They continue to spread through that continent, hitching chance rides in ship ballast water, on hulls, in cargoes.

\* One of Dr. Strayer's current projects is assisting with the revision and editing of a monograph on the land and freshwater mollusks of New York state prepared in the early 1900s by the eminent zoologist Henry A. Pilsbry.

It was ballast water discharged by a ship from a freshwater European port that introduced the zebra mussel to Lake St. Clair in the Great Lakes in 1985. The larvae rapidly became established in Lakes Erie, Ontario and Michigan as well as in the St. Lawrence River. Dr. Strayer learned of the situation at the time of the mollusks' population explosion in Lake Erie.



TOM TAFT

Dr. Strayer examines zebra mussels from Lake Erie.

Zebra mussels grow in densities of from 100 - 10,000 adults per square meter (one square meter is slightly larger than one square yard). Upon seeing the sizes of these clumps, one might assume that there would be major changes to the local ecosystem, from phytoplankton abundances to the patterns of water flow, as a result of the invaders' masses. Such changes, however, have not been well-documented: the United States invasion is too young yet to know what long-term changes occur in the ecosystem, while in Europe the mussels arrived before the disciplines of limnology and ecology existed, so a record of the situation prior to the late 1700s does not exist.

Some changes, of course, already have been noticed in areas where zebra mussels are abundant. Lake Erie swimmers appreciate that the water has become clear, a result of the filter-feeding behavior of the animals. Boaters, however, whose outboard motor cooling systems are clogged and who feel increased drag from the animals on their boats' hulls, look at the invaders in a less positive light. Those who take water from

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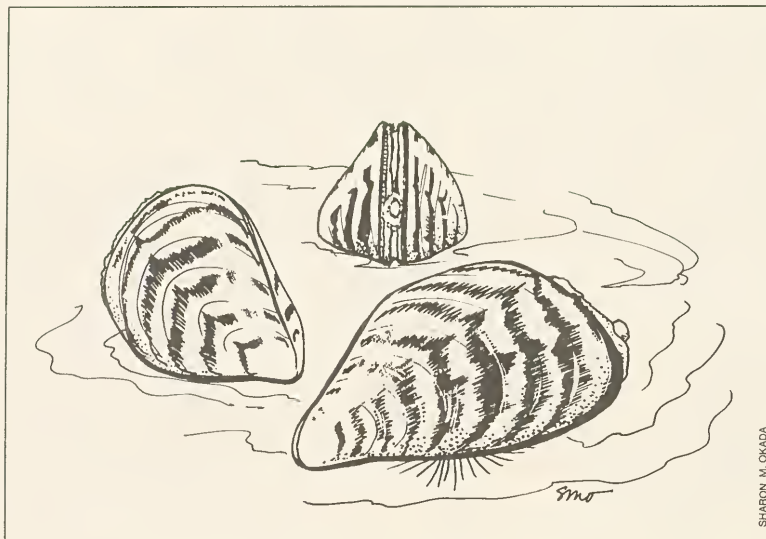
## Zebra Mussels, from page 1

the lakes find clogged intake pipes. Bird-watchers at Point Pelee, in western Lake Erie, are beginning to spot increased numbers of scaup in that area. This could be an early sign of changes in migration patterns. Birders in Europe have recorded major changes in the migration patterns of diving ducks there — even some marine species such as eiders and scoters now flock to lakes and waterways with large populations of zebra mussels.

In Europe, ducks are the major predators on zebra mussels; few fish there eat mollusks. In the United States, however, there are some species of fish that are specialized for mollusk hunting — the freshwater drum, for example, has jaws that are adapted for crushing shells. In spite of this, Dr. Strayer suspects that, as in Europe, there won't be anything here that will serve as a natural control. Can the mussels be harvested for food? Dr. Strayer says that while he has yet to taste one, reports from Europe suggest they are inedible.

What, then, can be done? The answer, unfortunately, is "nothing": we are stuck with these new inhabitants of our aquatic ecosystems. We cannot control or manage them, and we cannot predict where they will go. Certain results of the

growing population, however, can be dealt with. For example, using European technology we can engineer new intake systems to eliminate the fouling of pipes. We can also learn from our mistakes: a bill proposed recently by Senator John Glenn of Ohio has been passed requiring ships to



*In the lateral view of a zebra mussel (right), note the byssal threads for attachment and, extending from the right-hand edge of the shell, one of two siphons used for water and nutrient intake and discharge. A siphon is also shown in the posterior view (above center), as an oval opening in the mid-line.*

exchange ballast water at sea. (In 1980 a group of biologists working in the Great Lakes advocated such a bill, to no avail. They knew that ballast water carried living organisms, and that it was inevitable that at some point foreign pest species would be introduced here.)

What does the future hold for the Hudson River? There was a brief scare in late fall when a mollusk resembling a zebra mussel was found, but the animal was shown to be another species, already a known resident of the river. Dr. Strayer says that it is difficult to predict when zebra mussels first will arrive. Eventually, inadvertently, someone will dump a bait bucket full of contaminated water into the river, or move a boat from Lake Ontario to the Hudson River without first cleaning out the fresh-water cooling system. He guesses that people who use the river will be noticing them in some numbers by 1992-93. "This is a good chance," he adds, "to get data before the mussels arrive" . . . to get the kinds of data that Europeans never had a chance to collect.

Dr. Strayer is already taking advantage of this opportunity. With funding from the Hudson River Foundation, he is surveying the benthic, or bottom-living, animal communities of the Hudson in order to accumulate baseline information against which impacts of the zebra mussels can be measured.

## IES Notes

. . . Dr. Clive G. Jones spent four months in Australia and New Zealand under the auspices of a Winston Churchill Traveling Fellowship. This award, offered annually by the New York Branch of the English-Speaking Union, provided Dr. Jones, a chemical ecologist, with the opportunity to interact with colleagues on the subject of relationships between plant stress and disease resistance.

. . . Another IES ecologist who has been working abroad is Dr. Charles D. Canham. Recipient of a Foreign Specialist Fellowship from the Japanese Government, Dr. Canham spent three months at the Forestry and Forest Products Research Institute in Tsukuba. There, he and Dr. Tohru Nakashizuka collaborated on studies of forest dynamics in the highly diverse temperate forests of central Japan.

. . . At a December 8 ceremony in Poughkeepsie, the Institute's contribution to Earth Day 1990 was recognized by the local chapter of "Beyond War," a national group dedicated to assuring a secure and sustainable future for the global community. IES was one of two Dutchess County organizations honored at a ceremony following a live satellite broadcast of the presentation of the 1990 Beyond War Awards to Gro Harlem Brundtland, prime minister of Norway; Václav Havel, president of Czechoslovakia, and the people of Czechoslovakia; and Earth Day International 1990.

. . . Six hundred fifty-eight students from 15 Dutchess County schools participated in the IES Fall Ecology Programs in Pond Ecology and Acid Rain, led by program specialist in ecology education Diana

Wilson. These programs involved the exploration of a pond on the Arboretum as well as experimentation using the Institute's Ecology Discovery Ponds.

. . . Dr. Steward T.A. Pickett, one of 12 IES scientists who attended the Ecological Society of America meetings this summer in Snowbird, Utah, was co-organizer of a symposium that explored the "balance-of-nature" concept (the long-standing assumption that the normal condition in nature is stability, or equilibrium). A July 31 *New York Times* article described Dr. Pickett's presentation of new evidence that has led many ecologists to believe that nature is actually in a continuing state of disturbance and fluctuation.

# Certificate Recipients Honored

During 1990, more than 900 students enrolled in IES Continuing Education Program courses, workshops and ecological excursions. A number of these students are working toward certificates in landscape design or gardening, and on November 9 in the lobby of the Plant Science Building a ceremony was held to honor those students who have completed successfully the requirements for a certificate.

Prior to the presentation of certificates,

head of education Dr. Alan Berkowitz invited IES director Dr. Gene E. Likens to the podium. Dr. Likens welcomed and congratulated the graduates, and spoke briefly about the Institute's recent progress and plans for the future. Jacqueline Gantnier, program leader for continuing education, then introduced Ruth W. Page, the evening's guest speaker. The former editor-in-chief of National Gardening magazine and author of *Ruth Page's Gardening Journal* gave a lively and

informative talk on "The Home Landscape: My Piece of the Environment."

Ms. Gantnier then read the names of the program graduates: 14 students were recognized for the completion of a certificate in landscape design, and another 14 for receipt of a certificate in gardening. In addition, one student was awarded a certificate in horticultural therapy.

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## Ecosystem Workshop for UNEP Fellows

Mid-career environmental managers from developing nations receive training at Tufts University in Medford, Massachusetts, under the auspices of the United Nations Environment Programme (UNEP). This year, the schedule included a two-day workshop at IES, during which Institute ecologists spoke on their areas of expertise and met informally with the UNEP Fellows

to exchange ideas. Dr. Alan Berkowitz, head of education at the Institute, coordinated the IES workshop.

Four scientists, four engineers/managers, three lawyers and three environmental planners, representing ten nations, were this year's fellows. Their semester-long program included coursework, symposia

and workshops at field sites including the Woods Hole Oceanographic Institute, the Harvard Forest and IES. The participants in the UNEP/TUFTS program are selected by their government, and are required to lead workshops upon their return home in order that others may benefit from their new insights.

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## Appointments, Retirements

In the course of a year an organization expects to see arrivals and departures among its staff. At IES during the past 12 months, the departures primarily were of two types: post-doctoral associates whose positions were by nature short-term, and employees who retired after long and rewarding careers at the Arboretum and the Institute.

The Institute counts among its scientific staff a number of post-doctoral associates. After earning their doctoral degrees, qualifying ecologists are awarded one- to two-year research positions at IES. Here, they gain experience and training, develop new research areas and collaborate with Institute ecologists. Three IES post-doctoral associates have recently accepted appointments at other research institutions.

*DR. THOMAS S. BIANCHI*, with a Ph.D. in marine ecology from the Chesapeake Biological Laboratory at the University of Maryland, developed studies at IES to learn more about the ecology of aquatic invertebrates. In one such project, done in collaboration with aquatic ecologist Dr. Stuart E.G. Findlay, he investigated the relative importance of the three major sources of organic matter to the food web in the Hudson River: terrestrial (land), littoral (shore) and planktonic (microscopic plants

and animals in the river itself). Dr. Bianchi began work at the Department of Biology, Lamar University, Beaumont, Texas in mid-summer.

*DR. LARS O. HEDIN* received his Ph.D. from Yale University. His doctoral research, with IES Director Dr. Gene E. Likens as his thesis advisor, concerned the chemistry of rainfall. As an IES post-doctoral associate, Dr. Hedin continued his earlier studies and expanded his research to include a comparison of pollutants in precipitation from Sweden and from the Hubbard Brook Experimental Forest (site of the Hubbard Brook Ecosystem Study in the White Mountains of New Hampshire). In September, Dr. Hedin moved to Hickory Corners, Michigan, where he is an aquatic ecologist at Michigan State University's W.K. Kellogg Biological Station.

*DR. MARK D. MATTSON*, another of Dr. Likens' graduate students, received his Ph.D. from Cornell University. His thesis research was done at Mirror Lake in the Hubbard Brook Experimental Forest, where he investigated the role of anoxic (without oxygen) decomposition in the lake sediments. As a post-doctoral associate he continued this work and began a long-term study of the lake's hydrology and water residence time. Early this year Dr. Mattson received an appointment at the Water Resources Research Center at the

University of Massachusetts in Amherst.

Also within the past 12 months, four long-term employees retired. These individuals, each of whom served the Institute with distinction, are:

*MARVIN "MIKE" C. CHADWELL*, Gardener, Aug. 1977 - Dec. 1989

*MARCIA T. DAVIS*, Assistant to the Education Staff, Nov. 1977 - Sept. 1990

*RALPH L. ELLIOTT*, Maintainer, Nov. 1971 - Dec. 1989.

*WILLIAM R. NEWKIRK*, Maintainer (Carpenter), April 1975 - July 1990.

All seven employees made significant contributions to the Institute's short-term goals and long-term programs. Each will be missed.

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## IES Research and Results

The fourth edition of *Discoveries in Ecology: Research and Results at the Institute of Ecosystem Studies* has been published. Single copies of this summary of IES research during 1989 and 1990 are available at the Gifford House Visitor and Education Center.



## Winter Calendar

### CONTINUING EDUCATION PROGRAM

The **winter semester** begins in mid-January, with classes leading to certificates in landscape design and gardening, short courses, workshops and ecological excursions. If you are not on our Continuing Education Program mailing list, please call the office at the number below.

Among the highlights of the coming semester are three workshops:

Feb. 9: **The History of Hudson Valley Landscapes and Gardens**

Feb. 23: **Designs for a Flower Garden**

Mar. 16: **Planting the Seeds for Your New Business**

### SUNDAY ECOLOGY PROGRAMS

**Free public programs** are held on the first and third Sunday of each month, except over holiday weekends. Programs begin at 2 p.m. at the Gifford House on Route 44A unless otherwise noted. Call (914) 677-5359 to confirm the day's topic:

Jan. 20: **Deer Management Options**, a talk by Raymond Winchcombe

Feb. 3: **Human-Accelerated Environmental Change**, a slide presentation by IES Director Gene E. Likens

Feb. 17: President's Day — no program

Mar. 3: **A Simple Sample: Ecosystem Science from Start to Finish**, a talk and tour led by Kathleen Weathers

Mar. 17: **Maple Sugar Ecology for Kids**, a walk led by Diana Wilson.

*[Note: Kids must be accompanied by an adult. There is a maximum of 30 participants for this program, and reservations are required. Call Jill Cadwallader weekdays after March 1, at the number below.]*

*In case of inclement weather, call (914) 677-5358 after 1 p.m. to learn the status of the day's program.*

### IES SEMINARS

The Institute's program of **scientific seminars** features presentations by visiting scientists. These free seminars begin at 3:30 p.m. in the Plant Science Building.

Jan. 18: **Recent Work in Understanding the Ecology of Land Mosaics: Boundaries, Corridors, Graph Theory, Fragmentation, and Land Conversion**, by Dr. Richard T.T. Forman, Harvard Univ.

Jan. 25: **Coping with Predictable and Unpredictable Habitat Deterioration: A Tale of Two Moths**, by Dr. Jeremy McNeil, Université Laval, Quebec

Feb. 1: **Stable Isotopes and the Study of Aquatic Food Webs in the Baltic**, by Dr. John E. Hobbie, Director, The Ecosystems Center, Mass.

Feb. 8: **Ecological Role of Hurricanes in Tropical Forests**, by Dr. Douglas Boucher, American Association for the Advancement of Science, Washington D.C.

Feb. 15: **The Naked Mole-Rat and the Evolution of Eusociality**, by Dr. Paul Sherman, Dept. of Neurobiology and Behavior, Cornell

Feb. 22: **Quantifying Direct and Indirect Food Web Interactions: Grazing and Nutrient Recycling in the Trophic Cascade from Fish to Phytoplankton**, by Dr. Michael J. Vanni, University of Miami, Ohio

Mar. 1: **Macroevolution Revisited**, by Dr. Keith Stewart Thompson, President, The Academy of Natural Sciences, Philadelphia

Mar. 8: **Comparative Elemental Dynamics of Two Northern Hardwood Ecosystems: Huntington Forest and Turkey Lakes**, by Dr. Myron J. Mitchell, SUNY-CESF, Syracuse

Mar. 15: **Linkages Between Geothermal Processes and Stream Biogeochemistry in Volcanic Landscapes of Costa Rica**, by Dr. Catherine M. Pringle, Section of Ecology and Systematics, Cornell Univ.

### GREENHOUSE

The **IES greenhouse** is a year-round tropical plant paradise as well as a site for controlled environmental research. There is no admission fee, but visitors should first stop at the Gifford House for a free permit. During January and February the **begonias** of the Kolker Collection are in bloom, while **orchids** flower in February and March.

### GIFT SHOP

**Senior Citizens Days:** On Wednesdays senior citizens receive a 10% discount on all purchases (except sale items).

**Annual Holiday Clearance Sale, throughout January:** All merchandise discounted, with most remaining holiday items at half price.

**February 9 - 14:** 10% off all plants.

### ARBORETUM HOURS

(Winter Hours: **October 1 - April 30;**  
closed on public holidays)

The **Arboretum** grounds are open Monday through Saturday, 9 a.m. to 4 p.m.; Sunday 1 - 4 p.m.

The **Gift and Plant Shop** is open Tuesday through Saturday 11 a.m. to 4 p.m. and Sunday 1 - 4 p.m. (closed weekdays from 1 - 1:30 p.m.).

*All visitors must obtain a free permit at the Gifford House for access to the Arboretum. Permits are available up to one hour before closing time.*

### MEMBERSHIP

Members of the Mary Flagler Cary Arboretum. Benefits receive a special rate for IES courses and excursions, a 10% discount on Gift Shop purchases, a free subscription to the IES NEWSLETTER, and parking privileges and free admission to the Enid A. Haupt Conservatory at The New York Botanical Garden in the Bronx. Individual membership is \$30; family membership is \$40. For information, contact Janice Claiborne at (914) 677-5343.

*For more information, call (914) 677-5359 weekdays from 8:30 - 4:30.*

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